
Guidelines for the Avoidance of Vibration Induced Fatigue Failure in Process Pipework

2nd edition

GUIDELINES FOR THE AVOIDANCE OF VIBRATION INDUCED FATIGUE FAILURE IN PROCESS PIPEWORK

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CONTENTS

Foreword	iv
Acknowledgements	v
Summary	vi
1 Introduction	1
1.1 Overview	1
1.2 How to use these Guidelines.....	2
2 Overview of piping vibration	5
2.1 Overview	5
2.2 Introduction to vibration	5
2.3 Common causes of piping vibration	7
2.4 Vibration related issues	14
3 Undertaking a proactive assessment	16
3.1 Overview	16
3.2 Risk assessment	16
3.3 Main steps	17
4 Troubleshooting a vibration issue	28
4.1 Identifying a vibration issue	28
4.2 Approach	28
Technical modules:	
T1 Qualitative assessment.....	33
T2 Quantitative main line LOF assessment	47
T3 Quantitative SBC LOF assessment	70
T4 Quantitative thermowell LOF assessment	85
T5 Visual assessment – Piping	89
T6 Visual assessment – Tubing	108
T7 Basic piping vibration measurement techniques.....	114
T8 Specialist measurement techniques	119
T9 Specialist predictive techniques.....	122
T10 Main line corrective actions.....	126
T11 SBC corrective actions.....	140
T12 Thermowell corrective actions	147
T13 Good design practice	149
Appendices:	
Appendix A: Changes to approach from MTD Guidelines	151
Appendix B: Sample parameters	155
Appendix C: SBC L.O.F. assessment guidance	162
Appendix D: Worked examples.....	170
Appendix E: Terms	221
Appendix F: References	223

FOREWORD

The first edition of the Guidelines for the Avoidance of Vibration Induced Fatigue in Process Pipework was published by the Marine Technology Directorate in 2000 [0-1]. The document was based on the outcome of a Joint Industry Project, which was initiated in response to a growing number of onshore and offshore process piping failures especially within systems deploying extensive use of duplex stainless steel.

The Guidelines were augmented in 2002 with the publication of a Health and Safety Executive document covering transient pipework excitation associated with fast acting valves [0-2].

During 2004, copyright for the original Guidelines was transferred to the Energy Institute.

The original publication was intended principally for use at the design stage and in the period since first issue, more experience has been gained in practical application, and a number of potential extensions and improvements were identified. A second Joint Industry Project was therefore initiated to improve and expand the scope of the first edition. This commenced in late 2005 and was project managed by the Energy Institute, with Doosan Babcock and Bureau Veritas as specialist contractors. The objectives were to:

- i. Improve the overall usability of the Guidelines;
- ii. Update the assessment methodology to include the experience gained;
- iii. Include intrusive elements and extend the scope to a greater range of small bore connection designs;
- iv. Include the Health & Safety Executive publication.

The second edition now provides a comprehensive approach to the “through life” management of pipework vibration-induced fatigue. Both qualitative and quantitative assessment methods are provided, following a similar philosophy to that outlined in API581 [0-3].

This publication has been compiled for guidance only and is intended to provide knowledge of good practice to assist operators develop their own management systems. While every reasonable care has been taken to ensure the accuracy and relevance of its contents, the Energy Institute, its sponsoring companies and other companies who have contributed to its preparation, cannot accept any responsibility for any action taken, or not taken, on the basis of this information. The Energy Institute shall not be liable to any person for any loss or damage which may arise from the use of any of the information contained in any of its publications.

These Guidelines may be reviewed from time to time and it would be of considerable assistance for any future revision if users would send comments or suggestions for improvements to:

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SUMMARY

This document provides a public domain methodology to help minimise the risk of vibration induced fatigue of process piping. It is intended for use by engineers with no prerequisite knowledge of vibration.

Pipework vibration is only superficially covered by standard design codes, and hence awareness of the problem among plant designers and operators is limited (e.g. B31.1 **[0-4]**). It is intended that this document will address this issue.

These Guidelines can be used to assess (i) a new design, (ii) an existing plant, (iii) a change to an existing plant and (iv) a potential problem that has been identified on an operating system. They therefore offer a proactive approach to pipework vibration issues. This is in contrast to the highly reactive approach traditionally employed when vibration problems arise, e.g. during the commissioning or when operational changes are made.

These Guidelines provide a staged approach. Initially, a qualitative assessment is undertaken to (i) identify the potential excitation mechanisms that may exist and (ii) provide a means of rank ordering a number of process systems or units in order to prioritise the subsequent assessment. A quantitative assessment is then undertaken on the higher risk areas to determine the likelihood of a vibration induced piping failure. Details of onsite inspection and measurement survey techniques are provided to help refine the quantitative assessment for an as-built system. To reduce the risk to an acceptable level, example corrective actions are outlined.

It is recognised that there will always be some cases where the type of excitation or complexity of response is outside the scope of these Guidelines. In such cases specialist advice should be sought.